

The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DAVID S. MUI, WEI LIU, THORSTEN LILL,
CHRISTOPHER DENNIS BENCHER,
and YUXIANG MAY WANG

Appeal 2007-0706
Application 09/905,172
Technology Center 1700

Decided: July 25, 2007

Before CHUNG K. PAK, CATHERINE Q. TIMM, and
JEFFREY T. SMITH, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal from the Examiner's final rejection of claims 8 through 11, 13, and 15 through 40, all of the claims pending in the above-identified application. We have jurisdiction pursuant to 35 U.S.C. §§ 6 and 134.

STATEMENT OF THE CASE

The subject matter on appeal is directed to anti-reflection coatings and hard masks for use in defining etch patterns within an underlying substrate structure. (Specification 1). Further details of the appealed subject matter are recited in representative claim 8 reproduced below:

8. A method of forming a multilayer antireflective hard mask structure, said method comprising:

providing a substrate structure;

depositing a CVD organic layer over said substrate structure by a plasma enhanced chemical vapor deposition process using a feed stream that comprises a hydrocarbon species, said CVD organic layer comprising carbon and hydrogen;

depositing a dielectric layer over said CVD organic layer;

providing a patterned organic photoresist layer over said dielectric layer;

etching said dielectric layer through apertures in said patterned photoresist layer in a first plasma etching step until apertures are formed in said dielectric layer; and

etching said CVD organic layer through said apertures in said dielectric layer in a second plasma etching step until apertures are formed in said CVD organic layer.

As evidence of unpatentability of the claimed subject matter, the Examiner has relied upon the following prior art references:

Cheng	US 5,873,984	Feb. 23, 1999
Chapman	US 5,976,769	Nov. 2, 1999
Tsai	US 6,083,815	Jul. 4, 2000
Huang	US 6,171,940 B1	Jan. 9, 2001
Lou	US 6,200,881	Mar. 13, 2001

Hasegawa

US 6,452,274 B1

Sep. 17, 2002

The Examiner has rejected the claims on appeal as follows:

1. Claims 8 through 11, 13, 15 through 21, and 27 through 29 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Huang and Hasegawa;

2. Claims 22 through 24 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Huang, Hasegawa, and Tsai;

3. Claims 25 and 26 under 35 U.S.C. § 103 as unpatentable over the combined disclosures of Huang, Hasegawa, and Lou;

4. Claims 30, 31, 33, and 34 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Huang, Hasegawa, and Chapman; and

5. Claims 14, 32, and 35 through 40 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Huang, Hasegawa, and either Cheng or Chang and Chapman.

IV. ISSUE

Has the Examiner demonstrated that a person having ordinary skill in the art would have been led to employ the CVD (chemical vapor deposition) of the low dielectric organic material disclosed in Hasegawa as the low dielectric organic material taught by Huang in Huang's semiconductor making process within the meaning of 35 U.S.C. § 103?

V. RELEVANT FACTUAL FINDINGS

1. The Examiner has found, and the Appellants have not disputed, that:

Huang describes a method for forming a semiconductor device comprising: providing a substrate structure; forming an organic layer with low dielectric constant over the substrate; depositing a dielectric layer, SiON, over the organic layer; providing a patterned photoresist (claimed organic photoresist: please see cited art below) over the dielectric layer; etching the dielectric layer with dry etch (claimed first plasma etching) until apertures are formed in the dielectric layer; etching the organic layer using an anisotropic etching (claimed second plasma etching) until apertures are formed in the organic layer (col. 2, line 47-col. 3, line 17). (Compare Answer 3 with Brief and Reply Brief in their entirety.)

2. According to the Appellants at page 6 of the Brief:

Huang describes a semiconductor device and method of formation thereof. The device has a semiconductor substrate, an insulating layer, which may be organic, thereon, a dielectric layer thereon and a patterned photoresist thereon. The insulating layer is not described as comprising carbon and hydrogen and is not deposited by CVD. In fact there is no disclosure of any specific organic material.

3. Huang's organic layer with low dielectric constant is known to provide an insulation function (referred to by the Appellants as an insulation layer), but is not said to contain carbon and hydrogen and is not said to be deposited by CVD. (Compare Answer 3 with Brief 6.)

4. Hasegawa describes employing an organic layer with low dielectric constant comprising carbon and hydrogen as an insulation layer in producing a semiconductor device. (Compare Answer 3, with Brief 6.)

5. Hasegawa teaches (col. 9, ll. 4-12) that:

The dielectric layer can be formed, for example, by forming a precursor of the polymer by a spin coater and then baking at

300 to 500°C. In the case of a material such as amorphous carbon, the dielectric layer may be formed by using acetylene [carbon and hydrogen containing organic material] or, if necessary, a fluorocarbon gas and using a plasma enhanced CVD system.

6. The Appellants have not challenged the Examiner's official notice at page 8 of the Answer that "the CVD method is known to one skilled in the art at the time of the invention to deposit material[s] such as organic layer[s], used by Huang." (Compare Answer 8, with Br. in its entirety).

7. Huang discloses that one possible object of the invention is to use the low dielectric organic material for a purpose "analogous to a hard mask." (Col 1, ll. 48-51 and Col. 3, ll. 15-25).

8. Huang, by virtue of not specifically mentioning the names of low dielectric organic materials and deposition techniques, leaves one of ordinary skill in the art to appropriately choose conventional low dielectric organic (insulation) materials and deposition techniques. (Col. 2, ll. 49-65). Implicit in this teaching is that the selection of appropriate (known) low dielectric organic (insulation) materials and (known) deposition techniques is well within the ambit of one of ordinary skill in the art.

VI. PRINCIPLE OF LAW

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary consideration (e.g., the problem solved). *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18, 148 USPQ 459, 467(1966). "[A]nalysis [of whether the subject

matter of a claim is obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR Int’l v. Teleflex, Inc.*, 127 S. Ct. 1727, 1740-41, 82 USPQ2d 1385, 1396 (2007) quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336-37 (Fed. Cir. 2006); *see also DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361, 80 USPQ2d 1641, 1645 (Fed. Cir. 2006)(“The motivation need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself.”); *In re Bozek*, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969)(“Having established that this knowledge was in the art, the examiner could then properly rely, as put forth by the solicitor, on a conclusion of obviousness ‘from common knowledge and common sense of the person of ordinary skill in the art without any specific hint or suggestion in a particular reference.’”); *In re Hoeschele*, 406 F.2d 1403, 1406-07, 160 USPQ 809, 811-812 (CCPA 1969) (“[I]t is proper to take into account not only specific teachings of the references but also the inferences which one skilled in the art would reasonably be expected to draw therefrom . . .”).

VII. ANALYSIS

The Examiner’s rejections all hinge upon the combinability of primary reference Huang and secondary reference Hasegawa as the Appellants’ arguments are limited to these two references. In essence, the Appellants only contend that one of ordinary skill in the art would not have been led to employ the claimed CVD organic layer as the organic layer of

the semiconductor taught by Huang. The dispositive question is, therefore, whether the use of Hasegawa's organic material having low dielectric constant (used as an insulation layer) as the low dielectric organic material (admittedly known insulation material) in Huang's process would have been obvious to a person of ordinary skill in the art. On this record, we answer this question in the affirmative.

Here, Huang teaches a method for forming a semiconductor device comprising: a substrate structure; forming an organic layer with a low dielectric constant over the substrate; depositing a dielectric layer (SiON), over the organic layer; providing a patterned photoresist over the dielectric layer; etching the dielectric layer with dry etch (claimed first plasma etching) until apertures are formed in the dielectric layer; and etching the organic layer using an anisotropic etching (claimed second plasma etching) until apertures are formed in the organic layer. (Compare Answer 3 with Br. and Reply Br. in their entirety). As stated by the Appellants, “[t]he insulating [low dielectric organic] layer [of Huang] is not described as comprising carbon and hydrogen and is not deposited by CVD. In fact there is no disclosure of any specific organic material [and any deposition technique].” (Br. 6). Rather, Huang leaves one of ordinary skill in the art to conventionally deposit appropriate (known) low dielectric organic materials (admittedly known insulation materials in a semiconductor device). Hasegawa describes conventional low dielectric organic materials (used as an insulation layer for a semiconductor device), some of which contain carbon and hydrogen (col. 3, l. 45 to col. 4, l. 28, col. 1, ll. 9-10, and 8. 1. 66 to col. 9, l. 12). *See, e.g., Merck & Co. v. Biocraft Laboratories, Inc.*, 874 F.2d 804, 807, 10 USPQ2d 1843, 1846 (Fed. Cir.) *cert. denied*, 493 U.S. 975

(1989). Hasegawa teaches conventional deposition techniques, including CVD (col. 8, l. 66 to col. 9, l. 12). Moreover, there is no dispute that CVD is a known technique for depositing an organic insulation layer on a semiconductor substrate. (Compare Answer 8, with Br. and Reply Br. in their entirety).

Given that the selection of appropriate low dielectric organic (insulation) layers, including the claimed conventional low dielectric organic layer, and appropriate deposition techniques, including known CVD, is well within the ambit of one of ordinary skill in the art, we concur with the Examiner that one of ordinary skill in the art would have been led to employ, *inter alia*, the claimed CVD organic layer as the organic layer in Huang's process, motivated by a reasonable expectation of successfully forming the semiconductor device taught by Huang. *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. at 1739, 82 USPQ2d at 1395 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."); *Hoeschele*, 406 F.2d at 1406-07, 160 USPQ at 811-812 ("[I]t is proper to take into account not only specific teachings of the references but also the inferences which one skilled in the art would reasonably be expected to draw therefrom . . .").

In reaching this determination, we are cognizant of the Appellants' arguments which appear to be directed to the claimed preamble limitation "forming a multilayer antireflective hard mask structure." (Br. 2). However, as indicated *supra*, Huang and Hasegawa would have taught or suggested forming the claimed multilayer structure in the claimed manner (i.e., employing the claimed process steps). Moreover, Huang discloses that one possible object of the invention is to use the low dielectric organic

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material over a polysilicon layer “analogous to a hard mask.” (Col. 1, ll. 48-51 and Col. 3, ll. 15-25). However, on this record, the Appellants have not demonstrated that the claimed preamble limitation renders the claimed process steps materially different from those taught and/or suggested by the prior art references.

In view of the foregoing, we determine that the Examiner has established a *prima facie* case of obviousness and the Appellants have not sufficiently rebutted the *prima facie* case.

VIII. ORDER

Accordingly, the decision of the Examiner is affirmed.
No time period for taking any subsequent action in connection with this appeal maybe extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

sld/ls

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